- [1] A. Bagnall, J. Lines, A. Bostrom, J. Large, and E. Keogh, "The great time series classification bake off: a review and experimental evaluation of recent algorithmic advances," *Data Mining and Knowledge Discovery*, 2017, vol. 31, no. 3, pp. 606–660.
- [2] P. Esling and C. Agon, "Time-series data mining," *ACM Computing Surveys*, 2012, vol. 45, no. 1, pp. 1–34.
- [3] G. Chen, G. Lu, W. Shang, and Z. Xie, "Automated change-point detection of eeg signals based on structural time-series analysis," *IEEE Access*, 2019, vol. 7, pp. 180 168–180 180.
- [4] B. Liu, J. Li, C. Chen, W. Tan, Q. Chen, and M. Zhou, "Efficient motif discovery for large-scale time series in healthcare," *IEEE Transactions on Industrial Informatics*, 2015, vol. 11, no. 3, pp. 583–590.
- [5] G. He, Y. Duan, G. Zhou, and L. Wang, "Early classification on multivariate time series with core features," in *Proc. DEXA*, 2014, pp. 410–422.
- [6] S. M. Idrees, M. A. Alam, and P. Agarwal, "A prediction approach for stock market volatility based on time series data," *IEEE Access*, 2019, vol. 7, pp. 17287–17298.
- [7] J. Yin, Y.-W. Si, and Z. Gong, "Financial time series segmentation based on turning points," in *Proc. ICSSE*, 2011, pp. 394–399.
- [8] W. Pei, H. Dibeklioğlu, D. M. Tax, and L. van der Maaten, "Multivariate timeseries classification using the hidden-unit logistic model," *IEEE transactions on neural networks and learning systems*, 2017, vol. 29, no. 4, pp. 920–931.
- [9] P. Esling and C. Agon, "Multiobjective time series matching for audio classification and retrieval," *IEEE Transactions on Audio, Speech, and Language Processing*, 2013, vol. 21, no. 10, pp. 2057–2072.

[10] S. Aminikhanghahi, T. Wang, and D. J. Cook, "Real-time change point detection with application to smart home time series data," *IEEE Transactions on Knowl*edge and Data Engineering, 2019, vol. 31, no. 5, pp. 1010–1023.

- [11] R. H. Shumway and D. S. Stoffer, Time series analysis and its applications: with R examples. Springer, 2017.
- [12] A. Bagnall, J. Lines, W. Vickers, and E. Keogh, "The UEA & UCR Time Series Classification Repository," 2020. [Online]. Available: www.timeseriesclassification.com
- [13] D. Dheeru and E. Karra Taniskidou, "UCI machine learning repository," 2020. [Online]. Available: http://archive.ics.uci.edu/ml
- [14] A. Sharabiani, H. Darabi, A. Rezaei, S. Harford, H. Johnson, and F. Karim, "Efficient classification of long time series by 3-d dynamic time warping," *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, 2017, vol. 47, no. 10, pp. 2688–2703.
- [15] N. Hatami and C. Chira, "Classifiers with a reject option for early time-series classification," in *Proc. CIEL*, 2013, pp. 9–16.
- [16] K. Fauvel, D. Balouek-Thomert, D. Melgar, P. Silva, A. Simonet, G. Antoniu, A. Costan, V. Masson, M. Parashar, I. Rodero, and A. Termier, "A distributed multi-sensor machine learning approach to earthquake early warning," in *Proc.* AAAI, 2020.
- [17] A. Dachraoui, A. Bondu, and A. Cornuejols, "Early classification of individual electricity consumptions," Real-World Challenges for Data Stream Mining, 2013, pp. 18–21.
- [18] Z. Xing, J. Pei, G. Dong, and P. S. Yu, "Mining sequence classifiers for early prediction," in *Proc. SIAM*, 2008, pp. 644–655.
- [19] Z. Xing, J. Pei, and P. S. Yu, "Early prediction on time series: A nearest neighbor approach," in *Proc. IJCAI*, 2009, pp. 1297–1302.
- [20] Z. Xing, J. Pei, P. S. Yu, and K. Wang, "Extracting interpretable features for early classification on time series," in *Proc. SIAM*, 2011, pp. 247–258.

[21] W. Sousa Lima, H. de Souza Bragança, K. Montero Quispe, and E. Pereira Souto, "Human activity recognition based on symbolic representation algorithms for inertial sensors," Sensors, 2018, vol. 18, no. 11, pp. 4045–4069.

- [22] K. Li, S. Li, and Y. Fu, "Early classification of ongoing observation," in *Proc. ICDM*, 2014, pp. 310–319.
- [23] G. He, Y. Duan, T. Qian, and X. Chen, "Early prediction on imbalanced multivariate time series," in *Proc. CIKM*, 2013, pp. 1889–1892.
- [24] C.-L. Liu, W.-H. Hsaio, and Y.-C. Tu, "Time series classification with multivariate convolutional neural network," *IEEE Transactions on Industrial Electronics*, 2018, vol. 66, no. 6, pp. 4788–4797.
- [25] U. Mori, A. Mendiburu, S. Dasgupta, and J. A. Lozano, "Early classification of time series by simultaneously optimizing the accuracy and earliness," *IEEE transactions on neural networks and learning systems*, 2017, vol. 29, no. 10, pp. 4569–4578.
- [26] M. F. Ghalwash and Z. Obradovic, "Early classification of multivariate temporal observations by extraction of interpretable shapelets," BMC bioinformatics, 2012, vol. 13, no. 1, p. 195.
- [27] M. F. Ghalwash, D. Ramljak, and Z. Obradović, "Patient-specific early classification of multivariate observations," *International journal of data mining and bioinformatics*, 2015, vol. 11, no. 4, pp. 392–411.
- [28] C. Ma, X. Weng, and Z. Shan, "Early classification of multivariate time series based on piecewise aggregate approximation," in *Proc. HIS*, 2017, pp. 81–88.
- [29] S. Li, K. Li, and Y. Fu, "Early recognition of 3d human actions," ACM Transactions on Multimedia Computing, Communications, and Applications, 2018, vol. 14, no. 1s, pp. 1–21.
- [30] M. F. Ghalwash, D. Ramljak, and Z. Obradović, "Early classification of multivariate time series using a hybrid hmm/svm model," in *Proc. BIBM*, 2012, pp. 1–6.
- [31] Y.-F. Lin, H.-H. Chen, V. S. Tseng, and J. Pei, "Reliable early classification on multivariate time series with numerical and categorical attributes," in *Proc. PAKDD*, 2015, pp. 199–211.

[32] H.-S. Huang, C.-L. Liu, and V. S. Tseng, "Multivariate time series early classification using multi-domain deep neural network," in *Proc. DSAA*, 2018, pp. 90–98.

- [33] L. Zhao, H. Liang, D. Yu, X. Wang, and G. Zhao, "Asynchronous multivariate time series early prediction for icu transfer," in *Proc. ICIMH*, 2019, pp. 17–22.
- [34] G. He, W. Zhao, and X. Xia, "Confidence-based early classification of multivariate time series with multiple interpretable rules," *Pattern Analysis and Applications*, 2019, pp. 1–14.
- [35] V. S. Tseng, H.-S. Huang, C.-W. Huang, P.-F. Wang, and C.-F. Li, "Early classification of multivariate time series on distributed and in-memory platforms," in *Proc. PAKDD*, 2017, pp. 3–14.
- [36] A. Yazidi, B. J. Oommen, and M. Goodwin, "On solving the problem of identifying unreliable sensors without a knowledge of the ground truth: The case of stochastic environments," *IEEE transactions on Cybernetics*, 2017, vol. 47, no. 7, pp. 1604–1617.
- [37] H. Ghasemzadeh, P. Panuccio, S. Trovato, G. Fortino, and R. Jafari, "Power-aware activity monitoring using distributed wearable sensors," *IEEE Transactions on Human-Machine Systems*, 2014, vol. 44, no. 4, pp. 537–544.
- [38] M. Palatucci, D. Pomerleau, G. E. Hinton, and T. M. Mitchell, "Zero-shot learning with semantic output codes," in *Proc. NIPS*, 2009, pp. 1410–1418.
- [39] W. Jiang, Z. Zhang, F. Li, L. Zhang, M. Zhao, and X. Jin, "Joint label consistent dictionary learning and adaptive label prediction for semisupervised machine fault classification," *IEEE Transactions on Industrial Informatics*, 2015, vol. 12, no. 1, pp. 248–256.
- [40] O. Janssens, M. Loccufier, and S. Van Hoecke, "Thermal imaging and vibration-based multisensor fault detection for rotating machinery," *IEEE Transactions on Industrial Informatics*, 2019, vol. 15, no. 1, pp. 434–444.
- [41] M. F. Ghalwash, V. Radosavljevic, and Z. Obradovic, "Extraction of interpretable multivariate patterns for early diagnostics," in *Proc. ICDM*, 2013, pp. 201–210.
- [42] C. E. Rasmussen and C. Williams, Gaussian Processes for Machine Learning. Cambridge, MA, USA: MIT Press, 2006.

[43] G. Ahn, H. Lee, J. Park, and S. Hur, "Development of indicator of data sufficiency for feature-based early time series classification with applications of bearing fault diagnosis," *Processes*, 2020, vol. 8, no. 7, p. 790.

- [44] C. J. Alonso González and J. J. R. Diez, "Boosting interval-based literals: Variable length and early classification," in *Data mining in time series databases*, 2004, pp. 149–171.
- [45] R. Tavenard and S. Malinowski, "Cost-aware early classification of time series," in *Proc. ECML PKDD*, 2016, pp. 632–647.
- [46] Z. Xing, J. Pei, and S. Y. Philip, "Early classification on time series," *Knowledge and information systems*, 2012, vol. 31, no. 1, pp. 105–127.
- [47] U. Mori, A. Mendiburu, E. Keogh, and J. A. Lozano, "Reliable early classification of time series based on discriminating the classes over time," *Data mining and knowledge discovery*, 2017, vol. 31, no. 1, pp. 233–263.
- [48] M. F. Ghalwash, V. Radosavljevic, and Z. Obradovic, "Utilizing temporal patterns for estimating uncertainty in interpretable early decision making," in *Proc.* SIGKDD, 2014, pp. 402–411.
- [49] G. He, Y. Duan, R. Peng, X. Jing, T. Qian, and L. Wang, "Early classification on multivariate time series," *Neurocomputing*, 2015, vol. 149, pp. 777–787.
- [50] W. Wang, C. Chen, W. Wang, P. Rai, and L. Carin, "Earliness-aware deep convolutional networks for early time series classification," arXiv preprint arXiv:1611.04578, 2016.
- [51] L. Yao, Y. Li, Y. Li, H. Zhang, M. Huai, J. Gao, and A. Zhang, "Dtec: Distance transformation based early time series classification," in *Proc. SIAM*, 2019, pp. 486–494.
- [52] H. S. Anderson, N. Parrish, K. Tsukida, and M. R. Gupta, "Reliable early classification of time series," in *Proc. ICASSP*, 2012, pp. 2073–2076.
- [53] A. Dachraoui, A. Bondu, and A. Cornuéjols, "Early classification of time series as a non myopic sequential decision making problem," in *Proc. ECML PKDD*, 2015, pp. 433–447.

[54] A. Antonucci, M. Scanagatta, D. D. Mauá, and C. P. de Campos, "Early classification of time series by hidden markov models with set-valued parameters," in Proc. NIPS Workshop, 2015.

- [55] J. Lv, X. Hu, L. Li, and P. Li, "An effective confidence-based early classification of time series," *IEEE Access*, 2019, vol. 7, pp. 96113–96124.
- [56] U. Mori, A. Mendiburu, I. M. Miranda, and J. A. Lozano, "Early classification of time series using multi-objective optimization techniques," *Information Sciences*, 2019, vol. 492, pp. 204–218.
- [57] A. Sharma and S. K. Singh, "Early classification of time series based on uncertainty measure," in *Proc. CICT*, 2019, pp. 1–6.
- [58] M. Rußwurm, S. Lefevre, N. Courty, R. Emonet, M. Körner, and R. Tavenard, "End-to-end learning for early classification of time series," arXiv preprint arXiv:1901.10681, 2019.
- [59] C. Martinez, G. Perrin, E. Ramasso, and M. Rombaut, "A deep reinforcement learning approach for early classification of time series," in *Proc. EUSIPCO*, 2018, pp. 2030–2034.
- [60] C. Martinez, E. Ramasso, G. Perrin, and M. Rombaut, "Adaptive early classification of temporal sequences using deep reinforcement learning," *Knowledge-Based Systems*, 2020, vol. 190, p. 105290.
- [61] C. Ding and X. He, "Cluster aggregate inequality and multi-level hierarchical clustering," in *Proc. ECML PKDD*, 2005, pp. 71–83.
- [62] E. Keogh, K. Chakrabarti, M. Pazzani, and S. Mehrotra, "Dimensionality reduction for fast similarity search in large time series databases," *Knowledge and information Systems*, 2001, vol. 3, no. 3, pp. 263–286.
- [63] H. Li, "Piecewise aggregate representations and lower-bound distance functions for multivariate time series," Physica A: Statistical Mechanics and its Applications, 2015, vol. 427, pp. 10–25.
- [64] L. Ye and E. Keogh, "Time series shapelets: a new primitive for data mining," in Proc. SIGKDD, 2009, pp. 947–956.
- [65] M. D. Marzio and C. C. Taylor, "Kernel density classification and boosting: an l2 analysis," *Statistics and Computing*, 2005, vol. 15, no. 2, pp. 113–123.

[66] A. Papoulis and S. U. Pillai, Probability, random variables, and stochastic processes. Tata McGraw-Hill Education, 2002.

- [67] H. S. Anderson, N. Parrish, and M. R. Gupta, "Early time series classification with reliability guarantee." Sandia National Lab.(SNL-NM), Albuquerque, NM (United States), Tech. Rep., 2012.
- [68] S. Srivastava, M. R. Gupta, and B. A. Frigyik, "Bayesian quadratic discriminant analysis," *Journal of Machine Learning Research*, 2007, vol. 8, no. Jun, pp. 1277– 1305.
- [69] S. Ando and E. Suzuki, "Minimizing response time in time series classification," Knowledge and Information Systems, 2016, vol. 46, no. 2, pp. 449–476.
- [70] V. Mnih, K. Kavukcuoglu, D. Silver, A. A. Rusu, J. Veness, M. G. Bellemare, A. Graves, M. Riedmiller, A. K. Fidjeland, G. Ostrovski et al., "Human-level control through deep reinforcement learning," *Nature*, 2015, vol. 518, no. 7540, pp. 529–533.
- [71] M. Fazeen, B. Gozick, R. Dantu, M. Bhukhiya, and M. C. Gonzlez, "Safe driving using mobile phones," *IEEE Transactions on Intelligent Transportation Systems*, 2012, vol. 13, no. 3, pp. 1462–1468.
- [72] I. Tang and T. P. Breckon, "Automatic road environment classification," *IEEE Transactions on Intelligent Transportation Systems*, 2011, vol. 12, no. 2, pp. 476–484.
- [73] A. Abadi, T. Rajabioun, and P. A. Ioannou, "Traffic flow prediction for road transportation networks with limited traffic data," *IEEE Transactions on Intelligent Transportation Systems*, 2015, vol. 16, no. 2, pp. 653–662.
- [74] L. R. Rabiner, "A tutorial on hidden markov models and selected applications in speech recognition," *Proc. IEEE*, 1989, vol. 77, no. 2, pp. 257–286.
- [75] G. D. Forney, "The viterbi algorithm," *Proceedings of IEEE*, 1973, vol. 61, no. 3, pp. 268–278.
- [76] S. Garca, J. Luengo, and F. Herrera, Data Preprocessing in Data Mining. Springer Publishing Company, Incorporated, 2014.

[77] T. Chakraborty, A. U. Nambi, R. Chandra, R. Sharma, M. Swaminathan, Z. Kapetanovic, and J. Appavoo, "Fall-curve: A novel primitive for iot fault detection and isolation," in *Proc. SenSys*, 2018, pp. 95–107.

- [78] Fitbit, 2020. [Online]. Available: https://www.fitbit.com/
- [79] Biostrap, 2020. [Online]. Available: https://www.biostrap.com/
- [80] E.-Y. Hsu, C.-L. Liu, and V. S. Tseng, "Multivariate time series early classification with interpretability using deep learning and attention mechanism," in *Proc. PAKDD*, 2019, pp. 541–553.
- [81] K. H. Rosen, Discrete mathematics and its applications. New York: McGraw-Hill, 2011.
- [82] K. Yunus, T. Thiringer, and P. Chen, "Arima-based frequency-decomposed modeling of wind speed time series," *IEEE Transactions on Power Systems*, 2016, vol. 31, no. 4, pp. 2546–2556.
- [83] G. E. Box, G. M. Jenkins, G. C. Reinsel, and G. M. Ljung, *Time series analysis:* forecasting and control. John Wiley & Sons, 2015.
- [84] D. W. Scott, Multivariate density estimation: theory, practice, and visualization. John Wiley & Sons, 2015.
- [85] S. Salvador and P. Chan, "Toward accurate dynamic time warping in linear time and space," *Intelligent Data Analysis*, 2007, vol. 11, no. 5, pp. 561–580.
- [86] H. P. Gupta, H. S. Chudgar, S. Mukherjee, T. Dutta, and K. Sharma, "A continuous hand gestures recognition technique for human-machine interaction using accelerometer and gyroscope sensors," *IEEE Sensors Journal*, 2016, vol. 16, no. 16, pp. 6425–6432.
- [87] A. Shahroudy, J. Liu, T.-T. Ng, and G. Wang, "Ntu rgb+d: A large scale dataset for 3d human activity analysis," in *Proc. CVPR*, 2016, pp. 1010–1019.
- [88] A. Stisen, H. Blunck, S. Bhattacharya, T. S. Prentow, M. B. Kjærgaard, A. Dey, T. Sonne, and M. M. Jensen, "Smart devices are different: Assessing and mitigating mobile sensing heterogeneities for activity recognition," in *Proc. SenSys*, 2015, pp. 127–140.

[89] Y. Zhang, Y. Xu, Z. Y. Dong, Z. Xu, and K. P. Wong, "Intelligent early warning of power system dynamic insecurity risk: Toward optimal accuracy-earliness tradeoff," *IEEE Transactions on Industrial Informatics*, 2017, vol. 13, no. 5, pp. 2544–2554.

- [90] H.-T. Cheng, F.-T. Sun, M. Griss, P. Davis, J. Li, and D. You, "Nuactiv: Recognizing unseen new activities using semantic attribute-based learning," in *Proc. MobiSys*, 2013, pp. 361–374.
- [91] L. Zhang, T. Xiang, and S. Gong, "Learning a deep embedding model for zero-shot learning," in *Proc. CVPR*, 2017, pp. 2021–2030.
- [92] X. Wang, A. Mueen, H. Ding, G. Trajcevski, P. Scheuermann, and E. Keogh, "Experimental comparison of representation methods and distance measures for time series data," *Data Mining and Knowledge Discovery*, 2013, vol. 26, no. 2, pp. 275–309.
- [93] I. Goodfellow, Y. Bengio, and A. Courville, *Deep learning*. MIT press, 2016.
- [94] N. Helwig, E. Pignanelli, and A. Schütze, "Condition monitoring of a complex hydraulic system using multivariate statistics," in *Proc. I2MTC*, 2015, pp. 210– 215.
- [95] J. Fonollosa, I. Rodríguez-Luján, M. Trincavelli, A. Vergara, and R. Huerta, "Chemical discrimination in turbulent gas mixtures with mox sensors validated by gas chromatography-mass spectrometry," *Sensors*, 2014, vol. 14, no. 10, pp. 19336–19353.